

Notes on the Opisthobranchs of the West Coast of North America

I. Nomenclatural Changes in the Order Nudibranchia (Southern California)

by

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{Editor's Note: In the work preliminary to the preparation of the key to the opisthobranch mollusks of the west coast of North America, Miss Joan Steinberg has encountered a number of problems which she considers, quite rightly, should be dealt with before the key is completed. The present article is concerned with the first few of these; two other papers in this issue may be regarded as also contributing to the solution of some of these problems. - Since there are several serious gaps in our knowledge of this interesting group, gaps concerning assignment of certain species to a particular genus, as well as some others, we think that Miss Steinberg's approach is correct and that our readers will be glad to wait a little longer than originally anticipated for the completion of the keys which will, it is hoped, stimulate intensive further research in this group.}

The recent paper by Marcus (1961) on Opisthobranch Mollusks from California has contributed greatly to our knowledge of this group on the West Coast. However, it is evident that much more work is necessary, especially in those areas where little, if any, systematic collecting has been done, before we will really begin to appreciate the wealth of opisthobranchs in our fauna. For example, the only truly comprehensive list of nudibranchs from the West Coast of North America was prepared by O'Donoghue in 1926. It includes references and synonyms for all species known up to that time. However, O'Donoghue's work was compiled largely from the literature, and it has become apparent that a re-examination of a number of species is necessary in order to determine their validity or their exact systematic positions.

Earlier this year I had several opportunities to discuss systematic problems in the Order Nudibranchia with Mr. James R. Lance (Scripps Institution of Oceanography, La Jolla, California). Of primary concern to us were

certain species recorded from Southern California, the systematic status of which was open to question. This paper is the result of our mutual and separate investigations. Mr. Lance has incorporated the nomenclatural changes proposed herein in his forthcoming list of the Opisthobranchs from Southern California. {Ed. Note: See the following paper by J. Lance.}

I am deeply grateful to Mr. Lance for his wholehearted cooperation with my attempts to achieve some standardization of nomenclature for our West Coast opisthobranch fauna.

Primarily, only nudibranchs occurring in Southern California were considered for this paper, although the ranges of many of these extend far northward. Therefore, in certain instances, it has been necessary to examine and compare specimens and descriptions of animals from Washington and Vancouver Island, as well as from Northern California, in order to clarify the issues at hand. I would like to thank the staff and students at both the Friday Harbor Laboratories (University of Washington) and the Hopkins Marine Station (Stanford University) for their assistance. Dr. Leo Hertlein (Geology Department) and the library staff of the California Academy of Sciences were most helpful to me in locating literature.

In 1926, O'Donoghue listed three species of dorid nudibranchs belonging to the Family Dendrodorididae from the West Coast of North America:

- Dendrodoris fulva (MacFarland, 1905)
- Dendrodoris vidua (Bergh, 1878)
- Doriopsilla albopunctata (Cooper, 1863)

Doriopsilla albopunctata (Cooper, 1863) was first described as Doris (?) albopunctata from specimens obtained in deep water near Santa Barbara and from rocks at low water on Santa Catalina Island. In 1870, Cooper published additional distributional information on his species, stating that its range was from Baulines (sic., Bolinas) Bay to San Diego and that it was rare under stones at low water at Santa Cruz. Orcutt (1885) and Yates (1890), in faunal lists of mollusks from San Diego and Santa Barbara, respectively, also record Doris albopunctata but their records are based purely on Cooper's works. Orcutt has been the only author to utilize the information in Cooper's later paper, and it has been overlooked by subsequent workers.

In 1905, Cockerell and Eliot described a new species, Doridopsis reticulata, from San Pedro, which they suggested was probably identical with Cooper's form. O'Donoghue (1922a) later synonymized Cockerell and Eliot's species with Cooper's and, following Eliot's (1906) subsequent work on Cockerell's material, assigned it to the genus Doriopsilla.

However, also in 1905, MacFarland described a dendrodorid from Monterey Bay which he called Doriopsis fulva and which was later (O'Donoghue, 1926) referred to the genus Dendrodoris Ehrenberg, 1831. MacFarland, in his original description stated: "It is very possible that this species is identical with the Doris albopunctata of Cooper...". He concludes, however, that, aside from similarity in coloration, the brief description contained points which were at variance with his material and that, in the absence of Cooper's type specimens, identification was very difficult.

One point which led Mr. Lance and me to consider the possibility that perhaps we were dealing with two separate species, Dendrodoris fulva in Central California and Doriopsilla albopunctata in Southern California, was that the animals from the Monterey area are nearly always bright yellow, whereas the animals in the San Diego region vary from yellow in the very small animals to a warm brown, tending to yellow near the edge of the notum in the larger individuals. In the latter the white glands which both MacFarland and Cooper mention are quite conspicuous, especially against the darker background, whereas they must sometimes be looked for carefully in living animals from Monterey.

In July, 1961, I collected a number of spe-

cimens from Mission Point and Point Pinos on the Monterey Peninsula which matched MacFarland's description and color plate (1906) almost exactly. In addition, I also collected the darkest forms I could find. One specimen from Mission Point was quite orange in general appearance but, under a dissecting microscope, proved to have the white glands typical of MacFarland's species. Furthermore, it bore a great many brown dots dorsally which gave it a dusky orange color. Examination of more typical specimens showed that there is a great variation in the presence of these brown dots. Several of the specimens at either extreme of the color range for the Monterey forms (from bright yellow to dusky yellow) and also varying in size were taken alive by air to LaJolla. The next morning a large number of the larger-darker and smaller-lighter forms was collected at Point Loma. After careful examination of the coloration of animals from both localities, it was concluded that, although the southern forms may get much darker dorsally as the animal grows larger, we are only dealing with a color variation which varies with latitude. Several other nudibranchs on this coast exhibit a similar darkening in color depending on the latitude. [A good case in point is Diaulula sandiegensis (Cooper, 1862). Animals in the Vancouver Island and San Juan Island regions are much darker than animals from San Diego or Monterey, although darker specimens may occasionally be collected in Central California.]

The yellow color of small specimens from both localities does not differ at all. As far as could be determined by dissection, the reproductive systems of both fitted MacFarland's (1906) description, and the central nervous systems, as well as the anterior parts of the digestive systems, were identical with that described by Eliot (1906) for Doriopsilla reticulata. It is my opinion that the two are identical and that Cooper's specific name takes precedence over MacFarland's.

Having established the synonymy of the two forms, the question arises as to which generic name should be used. Dendrodoris is distinguished from Doriopsilla by having the buccal ganglia situated some distance from the central nerve ring in a bend in the esophagus but joined to the central ganglia by a pair of long commissures. In Doriopsilla, the buccal ganglia are located immediately behind the central nerve ring, the two ganglia being joined by a short commissure. Although, as Eliot points out, it

is difficult to determine the position of the buccal ganglia in relation to the rest of the nerve ring (except by sectioning), it was possible in the specimens I examined to determine that the position of the buccal ganglia was not as it is in Dendrodoris. The "strands" referred to by Eliot were first thought to be the long commissures to the buccal ganglia, but a more careful examination revealed their true nature.

Pruvot-Fol (1954), on the basis of the condition of the central nervous system, retains Doriopsilla as a distinct genus; however, Baba apparently considers it to be a subgenus of Dendrodoris (e.g., see Baba, 1949). Considering the fact that the central nervous systems of most of the numerous Dendrodorids which have been thus far described have not been investigated, I think that, until a thorough revision of the family has been undertaken on a worldwide basis, it is best to retain our species in the genus Dendrodoris belonging to the subgenus Doriopsilla. Until it can be shown that the condition of the central nervous system may be successfully used in separating genera in this very difficult family, I do not consider it wise to maintain Doriopsilla as generically distinct from Dendrodoris.

The precedence of Dendrodoris over other names has been thoroughly discussed (O'Donoghue, 1926, and Pruvot-Fol, 1954) and will not be repeated here.

I cannot agree with Eliot (1907) that MacFarland's Dendrodoris fulva (now D. albopunctata) is synonymous with Dendrodoris citrina (Cheeseman, 1880) from New Zealand. Apart from the great geographical separation of the two species, the two differ morphologically. Eliot describes the notum of D. citrina as "covered with numerous well-developed tubercles of rather irregular shape and size, and sometimes confluent." The notum of D. albopunctata is only minutely tuberculate. Furthermore, the buccal ganglia in D. citrina are some distance from the central nerve ring whereas, as has been pointed out, they are located directly behind the central nerve ring in D. albopunctata.

Cockerell and Eliot (1905) also described a dendrodorid from La Jolla as Doridopsis vidua (?) Bergh, 1878. The specimens had been sent to Eliot by Cockerell in California (as had his specimens of Dendrodoris albopunctata) and the latter worker believed his material to be a new species. Eliot suggested that, if the species were new, it should take Cockerell's manu-

script name, Doridopsis nigromaculata. Cockerell later (1908) listed this form as Doridopsis nigromaculata C & E (vidua Bergh, var. (?), thus suggesting that he was not in full agreement with Eliot's determination.

The only other mention in the literature of this species from California, apart from O'Donoghue's later comments and lists (1922a, 1926, 1927), is in a list by Kelsey (1907) of mollusks collected in San Diego. It is apparent from Kelsey's list that the nudibranch records, at least, were obtained from the literature. I am informed by Mr. Lance that nothing which fits Cockerell and Eliot's description has ever been seen by him in over ten years of intensive collecting in intertidal areas, as well as in deep water, in the San Diego area.

Eliot never commented again on this species, and it is my opinion that, in view of the great geographical separation of the type locality of Dendrodoris vidua (Tahiti) and Cockerell and Eliot's material [later referred to the genus Dendrodoris by O'Donoghue (1926)], it is most probable that, if specimens which can be referred to Cockerell and Eliot's description are eventually found, it will be shown that they are not synonymous with Bergh's species. For that reason I support Cockerell's contention that the name of this species should be Dendrodoris nigromaculata (Cockerell and Eliot, 1905).

Doris (Asteronotus) alabastrina (Cooper, 1862) is known from only one specimen collected by Cooper under stones at San Diego Bay. The description is very brief: "Alabaster white, opaque, form depressed-oval, dorsal tentacles short, acute, branchiae of twelve simple rays expanding in the posterior fifth of the body. Length, four tenth in., breadth, three tenths of an inch." This species was later assigned to the genus Aldisa Bergh, 1878, by O'Donoghue (1926) who commented, "As near as can be judged from the meager description given by Cooper, this animal... probably belongs to the genus Aldisa, as his Doris (Asteronotus) sanguinea is properly Aldisa sanguinea." I cannot agree that such a decision is warranted.

Nothing which could properly be ascribed to Cooper's species has ever been collected by Mr. Lance in the San Diego area, and none of the characters described by Cooper can be considered truly diagnostic. I therefore propose that Doris (Asteronotus) alabastrina Cooper, 1862, be treated as a nomen dubium.

Cabrilla occidentalis Fewkes, 1889, the

type species on which Fewkes based his genus Cabrilla Fewkes, 1889, is definitely allied to the genus Triopha Bergh, 1880, as O'Donoghue (1926) suggested. It is known from a single specimen obtained by Fewkes on a buoy chain in Prisoner's Harbor, Santa Cruz Island. The illustration which Fewkes provides does not really resemble any of the described species of Triopha, nor does the description of the color (greenish brown covered with light green spots). As no description of the radula or of the internal anatomy was included in the description, it is impossible to decide this form's exact systematic position. I suggest, therefore, that Cabrilla occidentalis Fewkes, 1889, be considered a nomen dubium.

The species comprising the genus Triopha need to be studied more thoroughly in order to determine how many species actually exist on our coast. Marcus (1961) lists seven species and tabulates the radular characteristics of each. An eighth species, Triopha catalinae (Cooper, 1863), the radula of which is unknown, is discussed below.

A ninth species, omitted from Marcus' list, is Triopha elioti O'Donoghue, 1921, described from the Vancouver Island region. O'Donoghue believed his species to be identical with a Triopha sp. described by Cockerell and Eliot in 1905. In 1922, O'Donoghue (1922b) discovered that Cockerell in 1908 had given the name Triopha aurantiaca to his material from San Pedro, California. O'Donoghue then applied Cockerell's name to his specimens. O'Donoghue was quite specific in stating that his animals were white with orange or red markings and compared this coloration to T. carpenteri (Stearns, 1873) which is white to yellowish white with orange and red markings. He apparently ignored completely the fact that Cockerell, in naming his species, stated clearly that his specimens were orange.

In the museum at the University of Washington laboratory at Friday Harbor, Washington, are two specimens belonging to the genus Triopha. I had the opportunity to examine them briefly in August, 1960, and found that the smaller specimen (approximately 40 mm.), which was grayish white in formalin, had a radula which was identical with that described for T. elioti. The number of rows in the radula was not counted but the radula formula was 8-9.4.2.2.4.8-9.

In order to determine the original color of this animal, I contacted the collector, Mr. Mi-

chael Marsh (Department of Zoology, University of California, Berkeley) who kindly provided me with the information that the coloration was like Triopha carpenteri.

The second specimen referred to above was collected during my stay at the Laboratory. It measured over 150 mm. in length. The color was yellowish with many dark brown flecks scattered over the notum, producing a dirty yellow. The dorso-lateral processes were orange-red, and there were more velar processes than MacFarland (1906) figures for Triopha carpenteri. Again, the number of rows in the radula was not counted, but the radular formula was 9.9-10.2.2.9-10.9. This fits the lower limit for the number of lateral and marginal teeth recorded for T. carpenteri.

As no orange Triophas are known from the Friday Harbor or Vancouver Island regions, it is evident that O'Donoghue's specimens are not referable to Cockerell's Triopha aurantiaca, although the radulae are similar. Further investigation will be necessary in order to determine the relationship of T. elioti to T. carpenteri.

As was mentioned above, the radula of Triopha catalinae (Cooper, 1863) is not known. The color described for this form resembles that of T. carpenteri and T. elioti as well as that of T. scrippsiana Cockerell, 1915. Triopha catalinae was first described from Santa Catalina Island, and later Cooper listed its range as being from Baulines (sic., Bolinas) Bay to Catalina Island, stating also that it was rare on stones at Santa Cruz. This range approximates the range for T. carpenteri which is known from Bodega Bay to Laguna Beach. Cooper's description is quite brief and offers no characters by which his species may be definitely allied to T. carpenteri. Moreover, his description could easily be applied to T. elioti or T. scrippsiana, although neither are known to occur within the range of T. catalinae. Marcus (1961) suggests that T. catalinae may have priority over T. carpenteri or T. aurantiaca (which he believed to be identical with T. elioti). I do not consider Cooper's description as adequate enough to permit definite identification of T. catalinae or to allow it to be compared with the other three species in this genus which it appears to resemble. I propose, therefore, that Triopha catalinae (Cooper, 1863) be considered a nomen dubium.

The only orange Triophid occurring in Southern California may possibly be Triopha

aurantiaca if Cockerell's species from La Jolla may be shown to be distinct from T. maculata MacFarland, 1905. Mr. Lance informed me that, although the specimens of Triopha in Southern California greatly resemble immature T. maculata, he has never seen anything resembling a mature T. maculata in either intertidal or deep water collections. Triopha maculata was recorded by O'Donoghue in 1927 as occurring at Laguna Beach, but he states that his specimens "... were orange or tawny in color, and covered with few or many small white spots. The processes on the sides of the dorsum and the oral veil, the tips of the branchiae and rhinophores were orange red." He describes the radula as having four to five lateral teeth and seven to eight marginal teeth on a side in each row, but figures only the first three lateral teeth and nine marginal teeth, the outermost one being quite small. It is, therefore, quite difficult to compare his description with T. maculata as it is known in Central California.

In July, 1961, I took with me to La Jolla several living specimens of Triopha maculata collected at Point Pinos on the Monterey Peninsula. The largest of these, about 25 mm. in length, was beginning to show the darker color typical of mature forms. The dots on its notum and sides were white. The other animals were uniformly orange-red. Ten specimens of the southern Triopha were collected the next morning at Point Loma and the material from both collections was compared.

Nine of the animals from Point Loma were small (averaging about 10 mm.) and were nearly identical in color and in size with the small specimen from Point Pinos, except that several of the Point Loma animals had grayish dorso-lateral processes which were only tipped with orange-red.

The tenth specimen from Point Loma was about 35 mm. in length. The ground color was pale orange with white spots and darker dusky orange dorso-lateral and velar processes and branchiae. The notum and sides were speckled with tiny brown flecks everywhere between the white spots. These brown flecks were much lighter than the brown flecks which caused the darker color in the largest specimen from Point Pinos.

All of the specimens from both localities were identical morphologically except for the velar processes which varied in number from nine to 13. All bore five dorso-lateral proc-

esses on a side, and all had four small tubercles arranged longitudinally down the midline of the notum as MacFarland figures for a mature Triopha maculata (1906, pl. XVIII, fig. 18).

Of the four small specimens from Point Loma whose radulae were examined, all had three hamate lateral teeth on a side in the complete rows and a fourth lateral tooth which had a poorly developed hook. The largest specimen had five hamate lateral teeth.

All of the specimens from Point Pinos had four lateral teeth on a side, the outermost lateral being well developed.

In view of the obvious absence of specimens from Southern California which are clearly referable to MacFarland's Triopha maculata as he described and figured it, I cannot now synonymize the Southern California form with that which occurs in Central California. It seems obvious that much additional work is necessary in order to separate clearly the species in this genus.

Marcus (1961) has pointed out that the number of lateral teeth increases and the number of marginal teeth decreases as the animal gets larger and describes the origin of the spurious rachidian teeth. I believe, as his discussion seems to point out, that this can happen only to a certain extent in a given species. In considering the genus as a whole, it appears that the radula may be of only secondary importance in identifying species. I suggest that some other set of characters must be selected for use in separating species in this genus.

It is apparent from O'Donoghue's list (1926) that he was unaware of the exact nature of Lateribranchia festiva Stearns, 1873, as he placed it with the phanerobranch dorids. It is correctly placed in the genus Tritonia by Marcus (1961) and has been known by workers on this coast variously as Duvaucelia or Sphaerostoma festiva since 1927 when Johnson and Snook published a short description and a colored figure of Tritonia festiva, presumably placing this species in its correct systematic position on the advice of Dr. MacFarland [see also Smith and Gordon, 1948; Steinberg (in Light, et al.), 1954].

The coloration of Tritonia festiva varies in California from completely translucent white to dull orange (occasionally light brown) and translucent white with opaque white markings. The variation of color does not seem to be consistent within a given geographical range. A

careful comparison of the description of Sphaerostoma undulata O'Donoghue, 1924, with a number of specimens from both Northern and Southern California reveals no differences other than that O'Donoghue encountered no specimens which exhibited the orange coloration commonly seen in California. The rachidian teeth of the largest animal in my collections (35 mm. in length, preserved, from Moss Beach, San Mateo County, California) resemble those described and figured by O'Donoghue for a specimen 48 mm. in length. The lateral cusps of the teeth are very much reduced. However, in a preserved 10 mm. long animal from the same locality, the lateral cusps of the rachidian teeth are much more prominent. I cannot find any characters which distinguish S. undulata from T. festiva and therefore synonymize the two, with T. festiva (Stearns, 1873) taking priority.

In treating the nudibranchs from Southern California, several comments on some of the species described by Guernsey (1912) from Laguna Beach must be included.

- a. Her Chromodoris sp. is, as O'Donoghue (1926) suggested, Glossodoris californiensis (Bergh, 1879).
- b. Mr. Lance informs me that specimens which conform to the illustration and to the coloration described for her Genus and Species (?) occasionally occur in great numbers on the kelp of the San Diego region. He considers them to belong to the genus Polycera Cuvier, 1816, and is in the process of describing this form as a new species.
- c. Guernsey's Doriopsis fulva MacFarland and Doris sp. are both Dendrodoris albopunctata (Cooper, 1863).
- d. O'Donoghue (1926) synonymized her Cuthonia (sic.) sp. with a species described by him (1922b) from Vancouver Island as Cuthonia concinna (Alder and Hancock, 1843) without comparative material from both localities. It will be necessary to obtain specimens from both areas for comparison before the exact systematic position of each may be ascertained.
- e. Hervia sp. ? Guernsey, 1912, was given the name Hervia lagunae by O'Donoghue (1926). The genus Hervia Bergh, 1871, is now considered to be a synonym of Facelina Alder and Hancock, 1855 (see MacNae, 1954). Guernsey's description does not permit her species to be assigned to any of the genera

to which other species, previously considered to belong to the genus Hervia, are now allocated. As O'Donoghue's name for this form was based only on Guernsey's description, I suggest that the name Hervia lagunae O'Donoghue, 1926, be considered a nomen dubium.

- f. Spurilla sp. Guernsey, 1912, was more completely described by O'Donoghue (1927) as Eolidina orientalis. This species has subsequently been synonymized, rightly, with Spurilla chromosoma Cockerell and Eliot, 1905, by Marcus (1961).

Neither the description of Facelina stearnsi Cockerell, 1901, in the original description of material from San Pedro nor in the subsequent description by O'Donoghue (1927) of a form from Laguna Beach which he somewhat tentatively considered to be Cockerell's species, give any characters by which these specimens may be assigned definitely to the genus Facelina, as it is now defined. The same holds true for Facelina hiltoni O'Donoghue, 1927. Additional collecting in the San Pedro and Laguna Beach regions may reveal specimens which may be referable to either or both of these species but, in such an event, further research will be necessary in order to determine their exact systematic position.

Coryphella cooperi Cockerell, 1901, appears to belong to the genus Coryphella and is compared to other species of the genus by Marcus (1961). However, it will be necessary to collect further in the San Pedro area, in the hope of obtaining specimens comparable to Cockerell's description, before this species may be compared fully with others in the genus.

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